Simulation of Hysteresis in a Misaligned Iron Nanopillar

Mark A. Novotny, Mississippi State University
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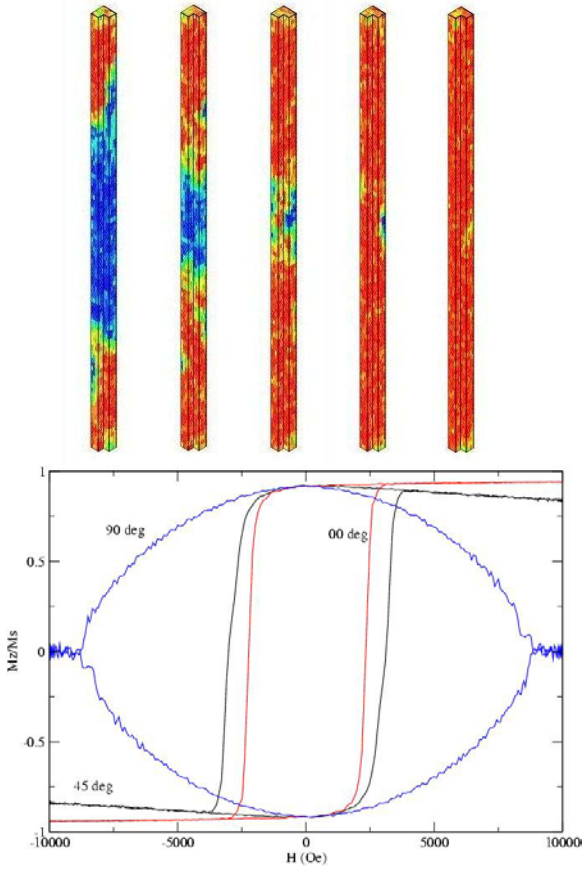
Magnetic nanoparticles are promising materials for ultra-high density magnetic recording media and magnetic RAM. Here we demonstrate the results of finite-temperature simulations of magnetization switching in 9 nm x 9 nm x 150 nm Fe particles, modeled on particles produced experimentally at Florida State University. The simulations use a stochastic differential equation (Landau-Lifshitz-Gilbert equation) for the local magnetization, which includes exchange and magnetostatic interactions, anisotropy, and random thermal fluctuations.



Simulated hysteresis of thermally activated magnetization switching with a misaligned field. Top: *z* component of magnetization with field misaligned to 45°. Red: stable direction. Blue: metastable direction. Bottom: hysteresis loops for different misalignments.

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Education:

Five undergraduates (Joyce Barksdale, Katrina Kennebrew, James Nail, Roderick Smith, and Shannon Wheeler), **four** graduate students (Terrance Dubreus, Hill Thompson, Poonam Verma, and Jeremy Yancey), and **four** postdocs (Alice Kolakowska, Kyungwha Park, Dan Robb, Steven Stinnett) were partially funded by this grant.

Underrepresented junior researchers supported: **six** women and **three** African-Americans.

International:

One female professor from Venezuela spent summers at MSU and FSU.

Outreach:

Students taking the *Einstein* test in Feb. 2003. 241 regional high school students from 21 schools near MSU competed in this annual competition.

PI Novotny making awards: Fall 2002 online MSU Full Moon Physics Competition winners in the ten-student division for high school students.